DENSITY™: Advancing Facial Rejuvenation Through Sequential Monopolar-Bipolar RF and Intelligent Cooling Systems

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Background

Facial aging involves gradual changes in skin laxity, descent of fat compartments, and weakening of ligaments. These changes result in visible sagging, volume loss, and contour irregularities.[1)] DENSITY™ is a cutting-edge non-invasive radiofrequency (RF) platform designed to target these issues through a unique combination of monopolar-bipolar sequential RF delivery, advanced cryogenic epidermal cooling, and real-time impedance monitoring. This white paper discusses the anatomical and physiological basis of DENSITY, examines its core technologies, and presents both preclinical and clinical results that demonstrate its safety and effectiveness.

1. Clinical Rationale: Targeting Aging Structures with RF

Facial aging is characterized by ligament laxity, descent of superficial fat compartments, and dermal atrophy, resulting in volume deflation, skin laxity, and loss of periorbital and lower face definition. Effective non-invasive rejuvenation targets the dermis and fibroseptal network — key structural elements responsible for maintaining skin tension and facial definition.[2)] By selectively heating these layers, RF energy promotes neocollagenesis and controlled tissue contraction without disrupting the epidermis. DENSITY's focused thermal delivery system is particularly well-suited for treating the midface, lower face, and periorbital regions, where structural support and skin tightening are most needed.

2. Technology Overview

2.1 Monopolar and Bipolar RF Modes

DENSITY™ offers two applicators: the Classic Tip (monopolar RF only) and the High Tip (sequential monopolar-bipolar). Monopolar RF enables deeper energy delivery by directing current from an active electrode to a distant return pad, facilitating tissue contraction and volumetric remodeling. Bipolar RF, by contrast, transmits energy between two closely spaced electrodes for more superficial, dermal-focused collagen remodeling.[3)]

2.2 Sequential RF Delivery: High Tip Advantage

Sequential RF delivery combines the volumetric heating of monopolar RF with the precision of bipolar RF, resulting in multi-depth remodeling within a single pulse cycle. The High Tip delivers four monopolar sub-pulses followed by one bipolar sub-pulse within a single composite shot. Preclinical evidence demonstrates that this monopolar-bipolar (MB) sequence results in greater collagen and elastic fiber density than monopolar or bipolar modes alone. The mechanism: monopolar energy conditions the tissue by reducing impedance, allowing the subsequent bipolar pulse to be more efficiently absorbed within the dermis. This staged delivery results in:

- Enhanced collagen and elastin regeneration
- Greater fibroblast activation (e.g., NRF2/GLO-1 expression)
- Stronger neocollagenesis in both papillary and reticular dermis

Compared to MM mode, MB treatment leads to a more balanced and targeted thermal profile, stimulating both deep volumetric contraction and superficial dermal tightening — with better histological outcomes and epidermal preservation.[4)]

2.3 Real-Time Impedance Feedback: Ensuring Consistent Energy Delivery

DENSITY™ features a real-time impedance feedback system that continuously monitors tissue resistance and automatically adjusts voltage and current to maintain a constant power output. This dynamic modulation ensures that energy delivery remains accurate and consistent, even when skin conditions—such as hydration, thickness, or contact pressure—vary across treatment areas.

Whereas other systems may underperform with variable impedance, DENSITY dynamically compensates to maintain energy precision across all skin types and tissue conditions.[5)] This precision:

- Reduces the risk of under- or over-treatment
- Enhances safety across diverse anatomical zones
- Improves treatment uniformity across patients

By preserving consistent power delivery under variable conditions, the system allows clinicians to achieve predictable clinical outcomes while maintaining optimal patient comfort and safety.

2.4 Cryogenic Cooling System

Unlike lasers, RF generates heat via tissue conductivity and water content, requiring epidermal protection to prevent burns and maintain comfort. DENSITY™ incorporates a cryogenic gas-based cooling system that delivers powerful, rapid cooling before, during, and after RF emission.

Notably, this cooling mechanism allows temperature modulation via five adjustable levels, allowing clinicians to tailor treatments based on patient tolerance, anatomical site, and depth of effect. The customizable cooling serves as both a protective and procedural tool, enabling precise control over thermal distribution based on anatomical and patient-specific factors. Clinical results demonstrate effective protection and enhanced tolerability.

This selective cooling contributes to an inverse thermal gradient—epidermal protection paired with deep tissue heating—which amplifies the reach and efficiency of RF stimulation.[6)]

3. Preclinical and Histological Validation

3.1 Murine Model (12-month-old C57BL/6N mice)

Figure 1 presents histological evidence comparing DENSITY Classic Tip and High Tip:

- Collagen fiber density (Masson trichrome): 47% increase at 28 days post High Tip treatment vs. 28% in monopolar only.
- Elastic fiber density (Verhoeff stain): 42% increase with High Tip vs. 24% in monopolar.
- Newly synthesized collagen (Herovici stain): increased synthesis visible in papillary and reticular dermis.

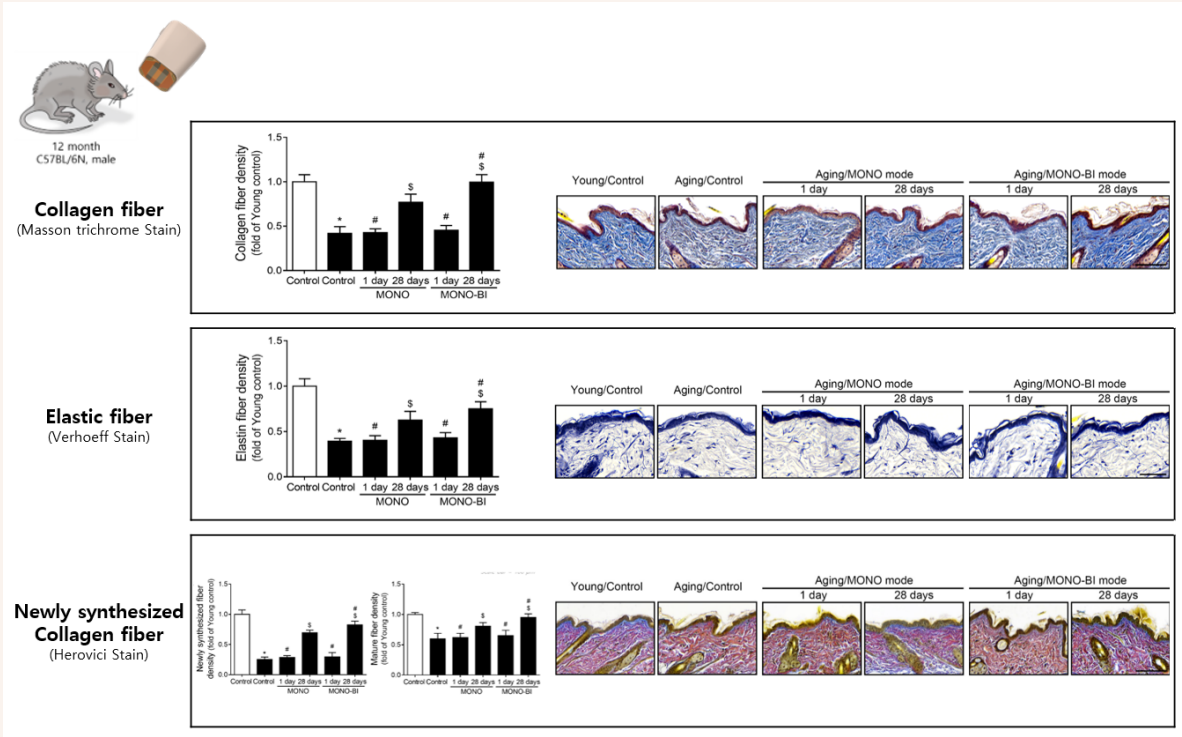

Figure 1. Histological Remodeling After Sequential RF in Aged Skin

These findings confirm the synergistic benefits of sequential MB mode and the safety of the cooling system.[7)]

4. Clinical Applications and Patient Outcomes
4.1 Midface and Lower Face Rejuvenation

Figure 2.1 Case 1 - Pre- and post-treatment results following Density RF

Baseline | Month 1 | Month 3

Baseline | Month 1 | Month 3

Figure 2.2 Case 2 - Pre- and post-treatment results following Density RF.

Baseline | Month 1 | Month 3

Baseline | Month 1 | Month 3

Two patient cases were analyzed using before-and-after clinical photography. Treatments were performed using the High Tip (500 total shots per session), with energy levels tailored per case (ranging from 2.0 to 4.5).

Photographic and clinical assessments demonstrated:

- Improved jawline definition and contour
- Softening of the nasolabial folds
- Overall enhancement in lower facial symmetry and shape

These improvements were visually evident and supported by positive patient feedback.

4.2 Treatment Protocols

- Energy settings:
- Case 1: 3.0–3.5
- Case 2: 2.0–4.5
- Total shots: 500 per session (focused on midface, jawline, and periorbital regions)
- Cooling level: Set to level 2 in all cases to maintain comfort and minimize adverse events

4.3 Pain and Feedback Assessment

- Visual Analog Scale (VAS) pain scores ranged from 2 to 3, indicating mild to moderate pain levels
- All patients completed treatment without additional pain management or interruption

4.4 Safety Profile

- Minor adverse effects included transient edema and localized eczema in some cases
- All symptoms resolved within 24 hours using only ice packs and observation
- No use of medication was required
- No incidents of PIH, scarring, or prolonged downtime were observed

4.5 Patient Satisfaction and Perceived Improvement

- Patient satisfaction scores were rated 4/5 or 5/5 across all cases
- Reported improvements included:
- Enhanced facial contour
- Sharper jawline definition
- Shallower nasolabial folds
- All patients expressed satisfaction during follow-up, with no requests for retreatment

5. Benefits of Non-Invasive RF with DENSITY

- Minimal Downtime: Most patients can resume their daily activities immediately after treatment.
- Improved Tolerability: Advanced cooling significantly reduces procedural discomfort.
- Adaptability: Real-time impedance monitoring yields consistent results across various skin types.
- Patient Preference: Growing demand for non-invasive procedures aligns with DENSITY's capabilities.

6. Conclusion

DENSITY™ embodies the evolution of non-invasive RF by combining sequential monopolar-bipolar delivery with real-time impedance sensing and epidermal cryoprotection. These mechanisms promote volumetric heating, fibroblast stimulation, and visible tissue contraction while ensuring patient safety and comfort. Backed by preclinical histology, clinical imaging, and patient-reported outcomes, DENSITY offers a versatile and effective tool for non-surgical facial rejuvenation. As further long-term studies emerge, DENSITY is positioned to set a new standard in RF-based aesthetics.

References:

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